NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMMERCIAL FISH PONDS (Catfish)
(AC.)
Code 397A

DEFINITION

A water impoundment constructed and managed for commercial aquaculture (catfish) production.

PURPOSE

To provide a favorable water environment for producing, growing, harvesting, and marketing commercial aquaculture (catfish) crops .

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to:

- Impoundments that store water and are managed for commercial aquaculture purposes.
- All types of ponds installed or modified for commercial production of catfish.
- Class (a) dams having a product of storage times effective height of dam of less than 3,000 acre ft^2, effective height of dam less than 25 ft, and total storage less than 50 ac-ft.

This standard also applies on land where soil conditions, climate, water resources, and topography are suitable for constructing a pond or reservoir for commercial aquaculture (catfish) production that meets the following criteria and conditions:

1. Water quantity will be adequate considering evaporation, seepage, and need for water exchange.
2. Water quality will be suitable for use in aquaculture production or can be made satisfactory by suitable treatment.
3. Application of practical pond management techniques will achieve the desired level of production on a predictable basis.
4. Access to the site is available or can be constructed and maintained.
5. Provision will be made for any needed treatment of water released downstream from the pond.
6. Ponds will store the recommended depth and area of water needed for specific aquaculture products.
7. The location, design, and installation of ponds will comply with flood plain, wetland, and prime farmland regulations.

CRITERIA

The site must be protected from flooding, sedimentation, and contamination. The pond shall be protected from inundation or damage from a 25-year, 24-hour flood event, or larger if required by state and local laws and regulations. The soils within the pond area, as well as those in the contributing drainage area, must be checked for residues of pesticides and other harmful chemicals if past farming practices utilized potentially harmful chemicals.

Commercial aquaculture (catfish) ponds may be: (1) embankment ponds that intercept and store surface runoff water, or (2) excavated ponds that are completely enclosed by an embankment or dike and are filled by pumping or gravity flow.

Embankment ponds. Earthfill dams and embankments around excavated ponds shall meet or exceed the requirements specified for Pond - 378 with the following additional requirements:

1. The minimum elevation to the top of the settled embankment shall be increased to allow for wave action. This increased allowance shall be as specified in Table 1.

Table 1. Wave height

Minimum fetch* length	Wave height
ft.	ft.
0-330	0.5
330-660	1.0
660-1320	1.5
1320-5280	2.0

*Fetch is defined as the longest uninterrupted distance traveled by wind or wave.

2. The minimum top width of the embankment shall be 14 ft. and 20 ft. respectively, where it is to be used as a one-lane or two-lane road for harvesting, feeding, and management purposes and is non-public. Minimum side slopes shall be 3:1.

Excavated ponds. Ponds established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff shall have either an emergency spillway with a bottom width of at least 10 ft. or have an overflow pipe installed with sufficient capacity to remove a 10-yr., 24-hr. direct rainfall amount in 24 hours. A minimum 10 inch diameter pipe shall be used.

A 1.0 ft. minimum freeboard from pipe outflow crest to top of fill shall be required. Levee construction shall add the required settlement to the 1.0 ft. requirement. The pond bottom should be sloped to the outlet at a gradient of at least 0.2 ft. per 100 ft. A minimum 10 ft. berm shall be provided between the outside toe of the levee and top of bank of outlet drainage ditch.

Catfish ponds with less than 3 ft. of water against the embankment are considered excavated ponds and may be constructed with the following requirements:

Embankments that will be used as a road for management purpose shall have a minimum top width of eight (14) feet and a minimum side slope of three (3) horizontal to one (1) vertical. Embankments that are traversed only with All Terrain Vehicles (ATV) shall have a minimum top width of eight (8) feet.

Orientation. Rectangular ponds shall be positioned as nearly as possible as follows:

10 acres or less - long axis in the direction of prevailing wind, unless aeration devices are designed and installed.
More than 10 acres - long axis perpendicular to the direction of prevailing wind.

Water supply. Wells are the most desirable source of water, but any available source may be used if the quality and quantity are adequate. If water is pumped from rivers and streams or other sources where undesirable fish may be introduced, filters must be installed on the intake.

The minimum incoming water supply for adequate maintenance is considered to be 15 to 25 gal/min/acre. However, evaporation rates, fish-loading densities, and species requirements will be used in establishing specific rates. Flow shall be measured during periods of lowest flow. The pumping and pipeline facilities shall be located to best serve the pond, taking into account accessibility for maintenance and repair; protection from overflow and flood hazards; connections to power lines or fuel sources; and future expansion. Water entering the pond shall be aerated to increase dissolved oxygen and dissipate harmful gases if needed. This can be accomplished by falling, splashing, spraying, etc. Also, incoming water shall be as far away from the outlet drain as possible so that rapid removal of fresh water will be avoided. The desired free oxygen level in ponds is 3 to 5 parts per million, and fish kills may result at less than 2ppm. The oxygen level is typically lower in hot weather than in cold weather. Catfish grow rapidly when water temperature is 70 to 85 degrees F. The desirable water pH range is 6.5 to 9.0.

Reservoir/Pool Area. Soils and geologic characteristics are critical to design, installation, and successful operation of commercial fishponds of this type. Impoundments must be located in adequate geologic settings and in soils with acceptable permeabilities or be lined.

The geology and soils of the site shall be of such nature to permit storage of water at the required depth and volume considering dependability of water supply, sedimentation, season of use, evaporation, and seepage losses. The geology and soils properties and limitations of the site are

to be evaluated by a qualified specialist and shall be determined to be impervious enough to prevent excessive seepage, or shall be of type that sealing is practicable.

Pipes and conduits. Pump discharge through levees shall be installed above expected high water, and provisions shall be made to prevent pump and motor vibrations being transmitted to discharge conduits. Table 2 provides an estimate of the time required to fill selected size ponds with different well flow rates.

Depth. The preferred water depth for catfish production is 4 ft. to 6 ft. Ponds used for cage culture shall have a minimum depth of 5 ft. where cages are located. The minimum clearance below cage and pond bottom is 1 ft. with up to 3 ft. preferred.

Drains. The pond must have facilities for complete as well as partial drainage. Turn-down pipes, quick-release valves, bottom-water release sleeves, or other devises for water level control and pond management are to be included in the construction of the drain facility as appropriate. NRCS Conservation Practice Standard Pond-Code 378, shall be followed for conduit design and installation of anti-seep collars.

Pond bottom. Where fish are harvested by seining, the pond bottom shall be smoothed and free of all stumps, trees, roots, and other debris. Existing channels and depressions in the pond area shall be filled and smoothed.

Access and safety. Provisions shall be made for access to the site as well as access for operation and maintenance. Ramps shall be located as necessary to accommodate aeration and harvesting equipment. The steepest grade for equipment access shall be 20 percent (5:1 slope). Generally, level areas or restraining barriers shall be provided to protect pumps, motors, fuel tanks, and utility poles from vehicular traffic. Appropriate safety features and devices shall be installed or made available nearby to aid people who fall into the pond and to prevent such accidents.

Protection. A protective cover of vegetation shall be established on all exposed soil surfaces that have been disturbed in accordance with NRCS conservation practice standard Critical Area Planting, Code 342. Adequate provisions must be made to protect earth surfaces from wave erosion and turbulent water at pipe inlets and outlets. Fences shall be installed as necessary to exclude livestock and unwanted traffic. Road surfaces shall be graveled or otherwise treated to prevent vehicles from cutting deep ruts or sliding. Dams and levees shall be crowned to provide positive drainage.

The following additional criteria should be used for Catfish production

a. Open pond culture

Water depth - On relatively flat land, ponds should be 2.5 feet deep or deeper at the shallow end and sloped to depths of 6 feet at the outlet. On steeper land, ponds should have constant, year-round depths of 6 feet or more at the deepest points and at least 2.5 feet at the shallowest points.

Water quality - Water must be free of harmful pollutants. The landowner should determine water quality before constructing ponds. Water quality meets specifications if channel catfish survive, grow, and reproduce satisfactorily. General water quality parameters are:

Dissolved oxygen - The desired optimum dissolved oxygen level is above 5 parts per million (ppm).

Temperature - Catfish grow rapidly when water temperature is between 70 and 85°F.; growth is slow below 60 and above 90°F. Gradual warming from early spring lows of 40° to 75° F is needed for catfish to spawn most successfully.
pH - The desired range is 6.5 to 9.0, but pH may fall as low as 6.0 or rise to 9.5 for occasional short periods with no harm to fish.

Carbon dioxide - Carbon dioxide toxicity is related to oxygen levels. Fish usually show little distress at 15 ppm carbon dioxide if the dissolved oxygen level is high. At 25-30 ppm, carbon dioxide is harmful even if the oxygen level is adequate.

Iron - Well waters which contain high

ferrous iron concentrations can cause mortality by iron oxidizing (ferric iron) and settling on the gills in amounts that interfere with respiration. Aeration of the water combined with flow through a vegetated or a gravel lined channel for a distance of 200 feet (61 m) will reduce iron to acceptable levels.

Total Alkalinity - The buffering capacity of the water in production ponds should be at least 20 ppm and preferably in the range of 50 to 100 ppm.

Salinity - Catfish can be successfully grown in waters containing up to 8 ppt (8,000 ppm) salinity. Reproduction can occur up to around 2.5 ppt (2,500 ppm).

b. Cage culture

Water depth - At least 6 feet (1.8 m) deep over most of the pond.

Water quality - Same as for open pond culture. Dissolved oxygen level should get no lower than 2 ppm in cages.

CONSIDERATIONS

General

The owner/operator's objectives will dictate the level of development and management to be planned. The plan must be based on the limitations and potentials of available natural resources. A thorough aquaculture resource assessment must be made to determine the feasibility of the project. The planning is complete when all practice components essential to reaching the cooperator's management objectives have been identified.

Other planning considerations include the following:

- Application of practical pond management techniques should achieve the desired level of production on a predictable basis.
- Access to the site is available or can be constructed and maintained.
- Pond sites require access to electricity to provide water circulation and aeration.
- Ponds should store the recommended depth and area of water needed for specific aquaculture products.
- The location, design, and installation of ponds will comply with floodplain, wetland, and prime farmland regulations.

Water quantity

Water quantity will be adequate considering evaporation, seepage, and the need for water exchange. Consider the following:

- The effects on the water budget with emphasis on effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- The effects on the volume of downstream flow or aquifers that might cause undesirable environmental, social, or economic effects and contribute to water table decline from heavy pumping.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for specific field sites, based on the standard. The NRCS Construction Specification for Pond - 378 applies and will be used. Plans and specifications include construction plans, drawings, job sheets, construction specifications, narrative statements in conservation plans or other similar documents.

OPERATION AND MAINTENANCE

The plan for construction of the pond will have a plan for operation and maintenance prepared for use by those responsible for the system. This plan will outline the needed inspection, operation, and maintenance of vegetation, pipes, valves, spillways, roads, and other parts of the system.

REFERENCES

NRCS Conservation Practice Standards:
Critical Area Planting, Code 342
Pond, Code 378

Table 2. Filling time in hours for various size ponds to a depth of 4 feet using various capacity wells.

Assumptions: 326,000 gal. = 1 acre foot (ac-ft)

1 cubic foot per second (cfs) = 450 gallons per minute (gpm) = 2 ac-ft per 24 hours

Pond has flat bottom

CFS		0.44	0.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
GPM		200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
Acre	Acre Feet	Hours to Fill Pond with 4 Ft Depth of Water														
0.5	2	54.4	27.2	18.1	13.6	10.8	9.1	7.8	6.8	6.1	5.4	4.9	4.5	4.2	3.9	3.6
1.0	4	108.7	54.3	36.2	27.2	21.6	18.1	15.5	13.6	12.1	10.9	9.9	9.1	8.4	7.8	7.2
2.0	8	217	109	72	54	43	36	31	27	24	22	20	18	17	16	14
5.0	20	544	272	181	136	108	91	78	68	61	55	50	46	42	39	36
10	40	1087	543	362	272	216	181	155	136	121	109	99	91	84	78	72
15	60	1631	815	543	408	324	272	233	204	182	164	149	137	126	117	108
20	80	2174	1086	724	544	432	362	310	272	242	218	198	182	168	156	144
25	100		1358	905	680	540	453	388	340	303	273	248	228	210	195	180
30	120		1629	1086	816	648	543	465	408	363	327	297	273	252	234	216
35	140		1900	1267	952	756	634	543	476	424	382	347	319	294	273	252
40	160		2172	1448	1088	864	724	620	544	484	436	396	364	336	312	288
45	180			1629	1224	972	815	698	612	545	491	446	410	378	351	324
50	200			1810	1360	1080	905	775	680	605	545	495	455	420	390	360
60	240			2172	1632	1296	1086	930	816	726	654	594	546	504	468	432
70	380				1904	1512	1267	1085	952	847	763	693	637	588	546	504
80	320				2176	1728	1448	1240	1088	968	872	792	728	672	624	576
90	360					1944	1629	1395	1224	1089	981	891	819	756	702	648
100	400					2160	1810	1550	1360	1210	1090	990	910	840	780	720

$$\text{Time (hours)} = \frac{5{,}445 \times \text{Volume (ac-ft)}}{\text{Flow (gpm)}} = \frac{12.1 \times \text{Volume (ac-ft)}}{\text{Flow (cfs)}}$$